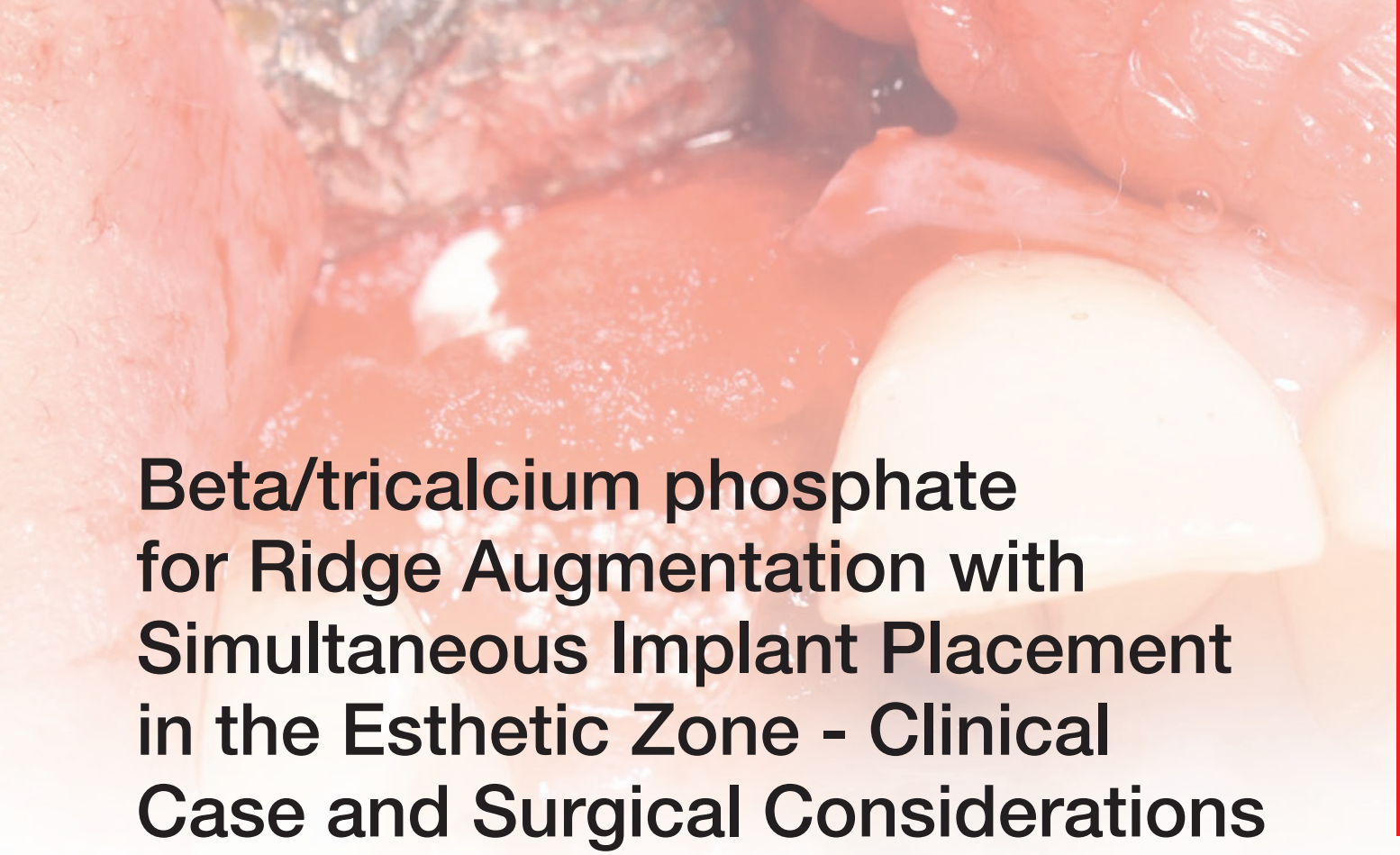

Beta/tricalcium phosphate for Ridge Augmentation with Simultaneous Implant Placement in the Esthetic Zone - Clinical Case and Surgical Considerations

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Introduction

Long-term aesthetics, associated with functionality, are integral part of successful implant treatment in well-defined esthetic zone. However, implant placement in the esthetic zone is a complex procedure that requires strict preoperative planning and precise surgical procedure based on prosthodontic-driven concept.

Following tooth extraction, implant can be placed in different time of bone and soft tissue healing, but predictable results should be weighed against the possible risk factors. Therefore, several timing of implant placements following tooth extractions are indicated depending of diagnostic factors of significance to the pre-operative examination of the aesthetic risk to the treatment outcomes (Chen, Buser 2008).
Mostly, because of dimensional bone changes after tooth extraction, unpredictable alveolar bone resorption may occur. The bone resorption affects buccal bone wall predominantly since vulnerable type of the bundle bone is integral part of buccal socket wall. However, dimensional changes affect a vertical dimension as well, resulted in difficulty of treatment and decrease of surgical success (Araujo et al. 2005, Chen et al. 2004). Therefore, different augmentation procedures are attempted to increase successful implant treatment in those patients. Having in mind all disadvantages of autogenous bone transplants, synthetic biomaterials can be useful to obtained sufficient bone volume prior to implant placement.
The aim of this report was to show indication when synthetic beta-tricalcium phosphate was used for localized alveolar ridge augmentation simultaneous with implant placement in the maxillary esthetic zone.

Case report

A 25-year-old healthy male non-smoker was referred to the Clinic of Oral Surgery, University of Belgrade, for implant placement in the position #12, 14 weeks after tooth extraction. After the consolidation, the date obtained were compiled for the esthetic risk-assessment table which showed a low esthetic risk having in mind medium patient's esthetic expectation, medium lip line position, thick and medium scalloped gingival biotype with intact and well defined keratinized gingiva (Figure 1). Positive effect was also confirmed with the rectangular crown shape associated with less than 5 mm to contact point at the adjacent teeth. The width of edentulous span enabled the restoration of one tooth ***(Fig. 1)***. No infection of residual alveolar ridge was diagnosed. Close inspection of the treated site determined horizontal deficiency which confirmed the need for a bone-augmentation procedure to address the buccal bone morphology ***(Fig. 2)***.

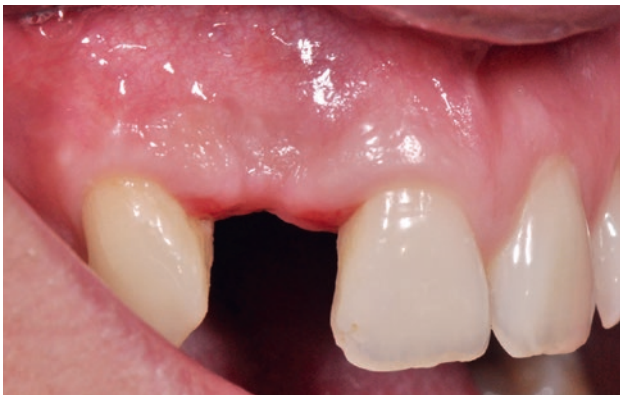

Fig. 1: Clinical observation before implant placement and bone augmentation

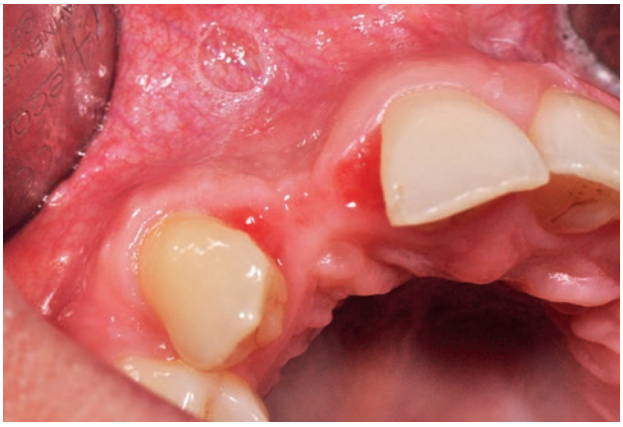

Fig. 2: Clinical observation of horizontal bone resorption

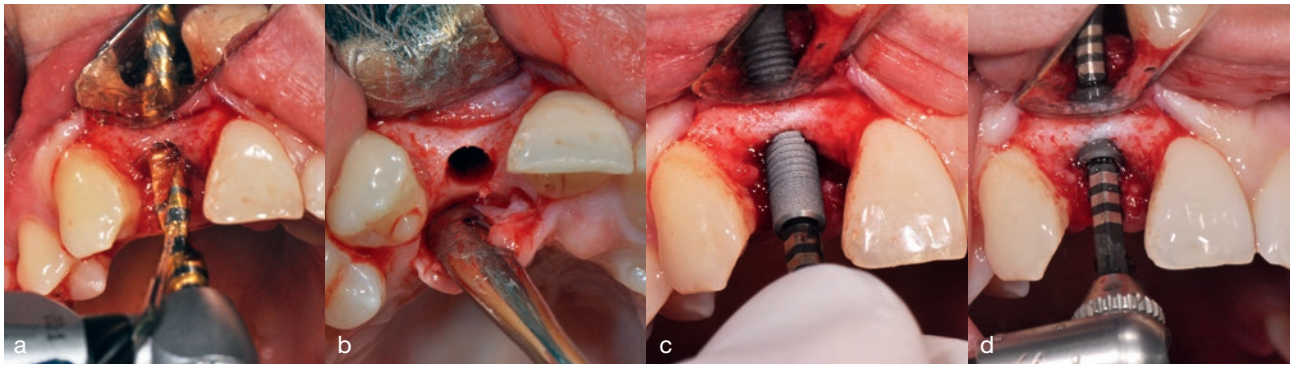

Fig. 3a, b, c, d: Surgical procedure of AstraTech TX implant placement in the maxillary esthetic zone

Under local anesthesia, a full-thickness flap was created with a crestal incision. The flap was extended through the sulcus of the adjacent teeth and elevated with a fine tissue elevator to allow low-trauma soft-tissue handling. Following flap elevation, the surgical site was carefully analyzed for sufficient bone and soft-tissue volume prerequisite for surgical treatment related with insertion of AstraTech TX implant ***(Fig. 3 a, b, c)***. The horizontal and vertical dimensions of alveolar ridge allow a correct three-dimensional position of an implant in the comfort zone ***(Fig. 4)*** with simultaneous bone augmentation since

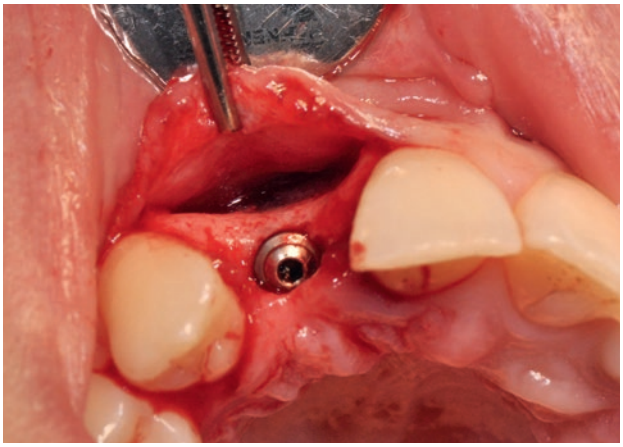

Fig. 4: Correct three-dimensional implant position

thin buccal bone wall ensure visualization of implants threads (***Fig. 5***). Bone augmentation was performed using beta-tricalcium phosphate (ßTCP) (RTR Syringe, Septodont, France). The procedure, which included a slight overbuild of the buccal contour of the alveolar bone, was intended to provide the required support and long-term stability for the overlaying soft tissue. In connection with a hemocollagen sponge (Septodont, France) was applied in two layers to create the condition for a ßTCP protection and buccal-gingival support during tissue regeneration procedure ***(Fig. 6 a, b, c)***.

After implant placement, initial stability of 81 ISQ was obtained ***(Fig. 7)***. The implant site was healed uneventfully. No signs or symptoms of complications were detected ***(Fig. 8 a, b)***. Since guided tissue regeneration was done, temporary implant-supported restoration was planned after 2 months of healing ***(Fig. 9)***.

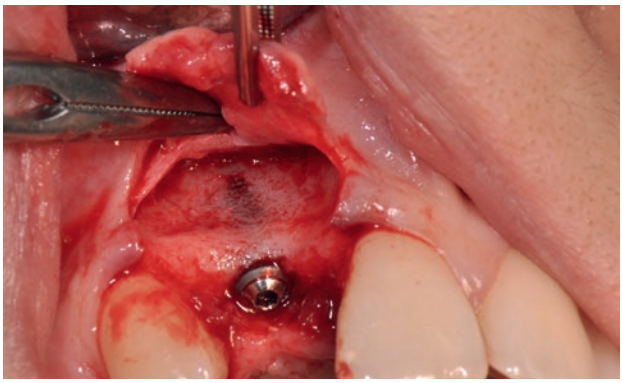

Fig. 5: Indication for buccal bone augmentation procedure

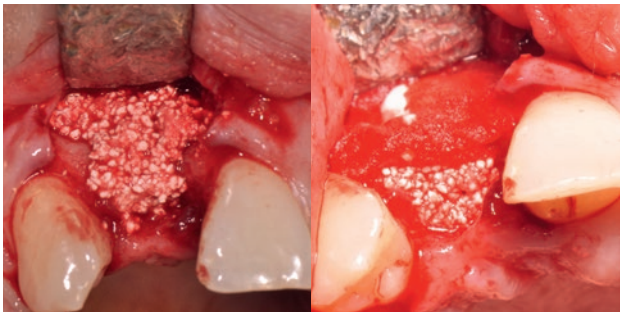

Fig. 6a, b: Usage of ßTCP for bone augmentation with implant placement - lateral view

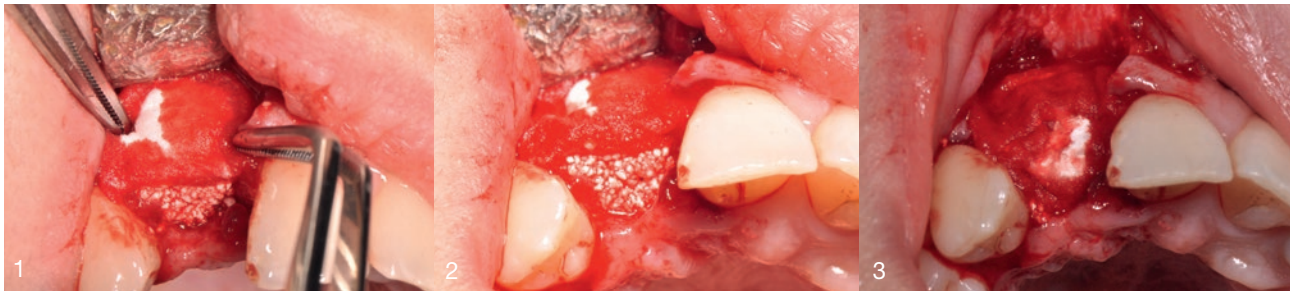

Fig. 6c (1, 2, 3): Position of hemocollagen covering particles of ßTCP

Fig. 7: Initial stability of inserted implant

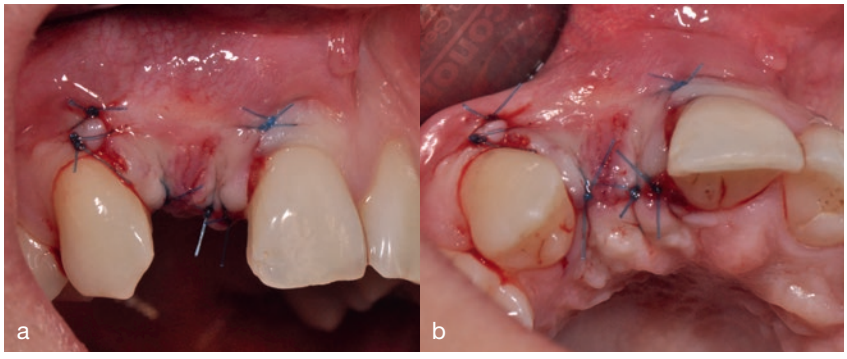

Fig. 8a, b: Postoperative view

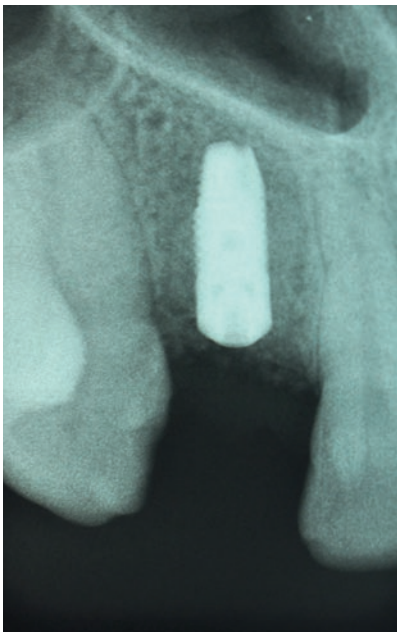

Fig. 9: Radiography 2 months after implant placement with simultaneous ßTCP bone augmentation

Discussion

There are several reasons to consider placement of dental implant early after partial bone healing, 14 weeks after tooth extraction (Type 3 timing of implant placement). Partial bone healing usually allows implant stability to be more readily attained with additional soft tissue volume, which may enhance soft tissue aesthetic outcomes. The quality and quantity of newly formed bone is quiet enough to obtained initial stability, as well as later osteointegration process, for implants placed in highly vascularized region of bone with a significant number of signaling molecules to accelerate bone healing. The healing period prior to implant placement allows resolution of any pathology associated with the extracted tooth while, additional soft tissue volume ensures easier attainment of tension-free closure in two-stage surgical approach. Conversely, two surgical procedures and extended treatment time are required. Regarding the healing period of socket walls, horizontal bone resorption is evident what can limit the volume of bone for implant placement (Markovic, Misic 2016).

Although a flattening of facial bone contours facilitates grafting of the facial surface of the bone, in majority of cases selected for Type 3 timing of implant placement, if happened, peri-implant defects are often present as two-or three-walled defects, which are favourable for simultaneous bone augmentation procedures as it has been presented. In those cases, synthetic bone substitutes can be used to improve bone healing.

Placement of biomaterial over the facial surface of buccal bone provides a scaffold for the in-growth of cellular and vascular components to form new bone of acceptable quality and quantity. The main characteristic of ßTCP particles is osteoconductive property. When mixed with a blood clot, osteogenic cells from surrounding bony walls, migrate inside and over the ßTCP particles. The cellular level of activity is also stimulated indirectly by the adhesive glycoprotein and fibronectin which are the first components accumulated at the ßTCP particles, supporting the process of osteoblastic differentiation and proliferation (Zerbo et al. 2001, 2005).

Significant resorption of ßTCP particles is expected between 3 to 6 months, while delay-time period of resorption was seen after 9 months when ßTCP in combination with Type I collagen was used for alveolar ridge preservation procedure (Brkovic et al. 2008, 2012). During observation time of bone healing, ßTCP become well incorporated into a new bone formation creating a dense cancellous bone. This biological status may significantly improve ability to withstanding loading forces transmitted by implants especially at the buccal vulnerable bone when it is used simultaneously with implant placement. Another biological characteristic of ßTCP is biodegradation occurs by both osteoclastic activity and chemical dissolution by tissue fluids (Fujita et al. 2003). Since ßTCP is a highly porous material, it is dissolved in particles well incorporated into newly formed bone and lacunar osteocytes system, continuing with a process of bone modeling and re-modeling.

Successful surgical result, with no significant differences, was presented in a one-stage procedure for horizontal bone augmentation when anorganic bovine bone and pure ßTCP both with bio-membrane were compared (Merli et al 2015). Also, in different surgical indication, ßTCP may be indicated. Kilic et al. (2017), investigated the influence of P-PRP or PRF on ßTCP-induced bone healing, showed findings of beneficial sinus-floor augmentation with ßTCP alone. Additionally, ßTCP presented satisfactory result for maxillary sinus lifting procedure regarding the maintenance of graft volume during the healing before the implant placement (Gorla et al. 2015), or 2.5 years after surgery (Okada et al. 2016), as assessed by means of CBCT.

This case report suggests that the use of ßTCP simultaneous with implant placement may result in the stable surgical outcome during the early bone healing phase.

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He is a mentor of 10 PhD thesis involved in several domestic and international scientific projects and an opinion leader for clinical courses and education for Septodont and AstraTech Implant System. Prof Brkovic has been an ITI Fellow since 2008. He is currently professor of integrated and postgraduate programs of oral surgery, implantology and dental anesthesia at the University of Belgrade.